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PAPERS

IN

CHEMISTRY.

CHEMISTRY.

The SILVER MEDAL was this Session voted to Mr. THOMAS WILLIS, of Lime-Street, London, for his Preparation of the BULBS of the HYACINTHUS NON SCRIPTUS, or COMMON BLUE-BELL, as a substitute for Gum-Arabic; the following Account of which was transmitted by him, with some of the prepared Powder.

SIR,

HAVING received a letter from Mr. Thomas Willis, relative to his discovery of the use of the Hyacinthus non scriptus, as a substitute for Gum Arabic; I request, at his desire, that you will lay the same before the Society of Arts, etc.

I am, SIR,

Your humble Servant,

JOHN BAKER.

Grosvenor-Street,
March, 1802.

Mr. CHARLES TAYLOR.

SIR,

I HAVE observed in the Appendix of the last Monthly Review, in their Report of the Chemical Annals, No. 115, that mention is made of a letter from Mr. Deyeux, to the authors of the Annales de Chymie; in which an account is given that a gummy substance had been discovered, by Mons. Leroux, to be contained in the Bulb of the plant called Hyacinthus non scriptus;

and that the Reviewers only say, " This " article does not at present require any further notice than annunciation." As I know, Sir, your benevolent disposition in promoting and encouraging the Arts, the Sciences, and Manufactures of this Kingdom, I beg leave to offer the following observations on the above-mentioned article, which I think a subject proper to lay before your most excellent Society, and which I have no doubt may become of national utility.

In the year 1794, whilst collecting plants in a wood for botanical specimens, I observed that the root of the Hyacinthus non scriptus, the plant commonly called Blue-Bells, or Hare-Bells, was extremely mucilaginous; and on tasting it, I discovered only a very slight pungency. I collected a pound of the Bulbs, and, after slicing and drying them before a fire, they yielded about four ounces of powder. I thought that by keeping the powder some time, the little acridness might go off, as it does in the arum-root powder. I tasted it about six months after, and found it perfectly insipid. I concluded it might be rendered useful for food or nourishment, but at that time pursued the matter no further.

In the spring of 1800, gum-arabic having been a long time very dear, and likely to continue so, I thought this mucilaginous root might answer some of its purposes, for external use. I therefore procured seven pounds and a half of the Bulbs, which, when sliced and dried, produced two pounds of powder. Being soon afterwards in company with Mr. Charles Taylor, Secretary to the Society of Arts, etc. I mentioned to him that I had discovered a root which grew in great plenty in this kingdom, yielded a very strong mucilage, and which I imagined would answer the purposes of gum arabic, in some of the manufactories. He said, if I pleased, he would send some of it down to Manchester, to be tried by the calico-printers.

Three or four ounces of the powder were given him, and sent down there: he was informed, upon trial, that it answered the purposes of fixing the calico-printers colours, equally as well as gum-arabic; and in the same proportion, of an ounce and a half of the powder, to four ounces of the mordant. Mr. Taylor received the samples of the printed cottons on which it had been used.

On the 15th of January, 1801, I furnished Mr. Taylor with eight ounces more of the powder; but have not since heard the result.

As this root can be easily procured, and used at a less price than gum-arabic has been sold for several years past, I think it may be rendered of great utility; and the Society of Arts, etc.

by patronizing it, may be the means of making it a public benefit.

Care should be taken, and advice given, that the woods should not be left destitute of the roots; and it would be adviseable to offer premiums for cultivating the roots and offsets, as they are very increasing. By such means a constant supply may be had, if the roots answer the intended purposes.

I do not presume to offer any thing respecting the mode in which the Society may think proper to divulge the discovery, and promote the use of these roots; but I imagine, that if the roots are bruised and used fresh, they would answer the purpose better than when dried and powdered; and as it is now a proper time of the year for taking them up, and will continue to be so for two months, I wish that the discovery may be made known as soon as possible.

I have sent you specimens both of the dried roots and powder, that they may be seen at the Society's rooms, by the calico-printers. What I have done have been scorched a little in drying; but the colour would be much better, if proper care was taken in drying them.

I am, Sir,

Your most obedient Servant,

Thomas Willis.

Lime-Street,
March 17, 1802.

To John Baker, Esq.
one of the Members
of the Society of Arts,
etc.

From the trials made before the Committee with this Powder, with hot and cold water, from samples of the printed cotton produced which had been printed therewith instead of Gum Senegal, and from experiments made in Manchester, it appears that the Hyacinthus non scriptus may, in many cases, be found a useful substitute for Gum-Arabic.

The following Processes for the EDULCORATION of FISH-OIL were communicated to the Society by ROBERT DOSSIE, Esq. in the Year 1761; and a Bounty of ONE HUNDRED POUNDS was then voted to him for the same. They have lately been enquired after by different Members of the Society, and are, on this account, published in the present Volume, in their original form.

Explanation of the Principles on which the PURIFICATION *of* FISH-OIL *may be performed, and of the Uses to which it is applicable.*

THAT the fetid smell of Fish-oil is chiefly owing to putrefaction, it is unnecessary to show; but though this be the principal cause, there is another likewise, which is, ustion or burning the oil, occasioned by the strong heat employed for the extracting it from the blubber of the larger fish, and which produces a strong empyreumatic scent that is not always to be equally removed by the same means as the putrid smell, but remains sometimes very prevalent after that is taken away.

In order to the perfect Edulcoration of Oils, there are consequently two kinds of fœtor or stink to be removed, viz. the putrid, and the empyreumatic; and the same means do not always equally avail against both.

The putrid smell of Fish-oil is of two kinds; the rancid, which is peculiar to oils; and the common putrid smell, which is the general effect of the putrefaction of animal fluids, or of the vascular solids, when commixed with aqueous fluids.

Fish-oil has not only rancidity, or the first kind of putrid smells peculiar to oils, but also the second or general kinds; as the oil, for the most part, is commixed with the gelatinous humour common to all animals, and some kinds with a proportion of the bile likewise; and those humours putrifying combine their putrid scent with the rancidity of the oil, and, in cases where great heat has been used, with that and the empyreuma also.

The reason of the presence of the gelatinous fluid in Fish-oil is this: that the blubber, which consists partly of adipose vesicles, and partly of the membrana cellulosa, which contains the gelatinous fluid, is, for the most part, kept a considerable time before the oil is separated from it, either from the want of convenient opportunities to extract the oil, or in order to the obtaining a larger proportion; as the putrid effervescence which then comes on, rupturing the vesicles, makes the blubber yield a greater quantity of oil than could be extracted before such change was produced; and the vesicles of the tela cellulosa, containing the gelatinous matter, being also burst from the same cause, such matter being then rendered saponaceous by the putrefaction, a part of it mixes intimately with the oil, and constitutes it a compound of the proper oleaginous parts and this heterogeneous fluid.

The presence of the bile in Fish-oil is occasioned by its being, in many cases, extracted from the liver of the fish; which is not to be so profitably done by other means as by putrefaction; and the bile being consequently discharged, together with the oil from the vessels of the liver containing them, combines with it, both from the original saponaceous property of bile, and from that which it acquires by putrefaction.

This holds good particularly of the cod-oil, or common train, brought from Newfoundland; which, from its high yellow colour, viscid consistence, and repugnance to burning well in lamps, manifests sensibly the presence of bile and the gelatinous fluid; which latter, by the saponaceous power of the bile, is commixed in a greater proportion in this than in any other kind of fish-oil.

A tendency to putrify, or at most but in an extremely slow manner, is not an absolute property of perfect oils in a simple or pure state; but it is a relative property dependant upon their accidental contact or commixture with the aqueous fluid. This is evident from the case of oils concreted into a sebaceous form; which being perfectly oleaginous and uncombined with any water, except such as enters into their component parts will not putrify unless water, or something containing it, is brought in contact with them. But the fluid animal, and most vegetable oils, being compounded of perfect oils with other mixed substances, either sub-oleaginous or gelatinous, have always a putrescence *per se*, or tendency to putrify, without further admixture of aqueous moisture.

This commixture of heterogeneous matter in Fish-oil, particularly of the gelatinous fluid and bile, gives rise to a further principle of purification than *simple Edulcoration*, or the removing the. fœtor; for the presence of such humours in the oil renders it subject to a second putrescence *per se*, supposing the first corrected; makes it unfit for the purpose of the woollen manufacture, as the heat through which this is in some cases employed, causes this matter to contract a most disagreeable empyreuma. It also prevents its burning in lamps, as well from its viscidity as from the repugnance which the presence of water gives to all oleaginous matter. It is therefore necessary to free the oil from this heterogeneous matter; after which it can be subject only to the rancid putrescence, or that which is proper to oils as such.

The substances which have been or may be applied to the removing or preventing the effects of putrescence, are, acids, alkalies, metallic calces, neutral salts, ethereal and essential oils, vinous spirits, water, and air. With respect to acids, though they may be applied with effect to the removal or prevention of putrefaction in mixed animal and vegetable substances, yet they have not the same efficacy when employed in the case of oils; for in a small proportion, without the subsequent aid of alkalies, they rather increase than diminish the fœtor, and in a large proportion they coagulate the oils, and change their other properties as well as their consistence. Though they might therefore be employed with the assistance of alkalies, yet requiring a more expensive and complex process, and not being moreover necessary, as the same end may be obtained by the use of alkalies only, they may be deemed improper for the purification of animal oils for commercial purposes. Alkaline substances, both salts and earths, are the most powerful instruments in the edulcoration of oils; but as their action on putrid oils, and the method of applying them to this end, are not the same in both, it is proper to consider them distinctly.

Of alkaline salts it is the fixed kind only which are proper to be used for the edulcoration of oils. Fixed alkaline salts, in a dissolved state, being commixed with putrifying animal substances, appear to combine with the putrid matter, and mixing with some of the principles, form instantly volatile alkaline salts. On the less putrid they seem to act, after their combination, by an acceleration of the putrescent action, till they attain the degree which produces volatile salts. This is evident by the sensible putrid ferment and smell which appear after their commixture; but which gradually abating, the oil is rendered sweeter, much lighter-coloured, and thinner.

Their great use in the edulcoration of Fish-oil arises, therefore, from their converting such parts of the gelatinous fluid and bile as are highly putrified, instantly into volatile salts, and causing a rapid putrefaction of the other parts; by which means the oil is freed from them by their dissipation. They do not, however, equally act on the parts of the oil on which the empyreumatic scent depends, unless by the assistance of heat; for when they are commixed with the oils without heat, in proportion as the putrid smell diminishes, that becomes more sensibly prevalent. The ultimate action of lixiviate salts on animal oils, except with respect to the empyreuma, seems to be the same either with or without the medium of heat; for the same urinous and putrid smell, gradual diminution of the colour, and fetid scent, happens in one case as in the other, except with regard to the acceleration of the changes; and such salts, where the purification is required to be made in a great degree, are a necessary means, as they are more effectual than any other substance that can be employed.

The use of lixiviate salts alone is not, however, the most expedient method that can be pursued for the edulcoration of oils, for several reasons. If they be used alone, cold, in the requisite proportions, they coagulate a considerable part of the oil, which will not again separate from them under a very great length of time; and when they have destroyed the putrid scent, a strong bitter empyreumatic smell remains. The same inconvenience, with relation to the coagulation of part of the oil, results when they are used alone with heat. The super-addition of common salt, (which resolves the coagulum and counteracts the saponaceous power of the lixiviate salt, by which the oil and water are made to combine) is therefore necessary; and the expence arising from the larger proportion of lixiviate salt, requires it to be employed if no other alkali be taken in aid, and renders the junction of alkaline earths with it extremely proper in the edulcoration of oils for commercial uses. Lime has also an edulcorative power on animal oils; but it has also so strong a coagulative action, that the addition of a large proportion of alkaline salts becomes, when it is used, necessary to reduce the concreted oil to a fluid state; and therefore this substance alone is not proper for that purpose. The combination of lixiviate salt with lime, or the solution commonly called soap-lye, has an effectual edulcorative action on fetid oils; but it makes a troublesome coagulation of part of the oil, if no common salt be employed, and must be used in such large proportion, if no alkaline earth be added, as renders the method too expensive.

Lime has a power of combining with and absorbing the putrid parts of the gelatinous fluid and bile, when commixed with oil; and effects, either with or without heat, a considerable edulcoration of fetid oils; but it combines so strongly with them, either cold or hot, that the separation is difficult to be effected, even with the addition of brine; and the oil, when a large proportion of it is used, can scarcely be at all brought from its concreted to a fluid state, but by an equivalent large proportion of lixiviate salt: the use of lime therefore, alone, is improper, or even in a great proportion with other ingredients. But when only a lesser degree of edulcoration is required, a moderate quantity, conjoined with an equal or greater weight of chalk, which assists its separation from the oil, may, on account of its great cheapness, be employed very advantageously: it will in this case admit of precipitation from the oil by the addition of brine. It may be also expediently used, when lixiviate salt is employed with heat for the most perfect purification of oils; for it will in that case give room for the diminishing of the quantity of lixiviate salt, though the proportion be nevertheless so restrained as not to exceed what the proportion of lixiviate salt (just requisite for the edulcoration) can separate from the oil.

Chalk has an absorbing power similar to lime, but in a less degree on the putrid substance of oil; it does not, however, combine so strongly with the oil as to resist separation in the same manner, and is therefore very proper to be conjoined either with lixiviate salts or lime, as it renders a less quantity of either sufficient, and indeed contributes to the separation of the oil from them.

Magnesia alba or the alkaline earth which is the basis of the sal catharticus, and the singular earth which is the basis of alum, both have an edulcorating power on fetid oils; but, like lime, have too strong an attraction with them to be separated so as to admit of the reduction of the oil from the concreted state to which they reduce it; and therefore, as they are not superior in efficacy to lime and chalk, but much dearer or more difficult to be obtained, they may be rejected from the number of ingredients that are proper for the purifying of oils, with a view to commercial advantages.

Sea-salt has an antiseptic power on the mixed solid parts of animals; but used alone, or dissolved in water, it does not appear to lessen the putrid fœtor of oils, but on the contrary rather increases it. If, after their commixture with it, they are subjected to heat, it rather depraves than improves the oils; but though by its own immediate action on them it conduces so little to the edulcoration of oils, yet it is a medium for the separation of water and the alkaline substances requisite to be employed to that end. It is of great utility in the edulcorative processes: for when alkaline salts or earths combine with the water necessary to their action on the oils, or themselves form coagulums or corrections with it, a solution of salt will loosen the bond and dissolve the close union; so that the oil being separated will float on the aqueous fluid, while the earth, if any be in the mixture, will be precipitated and sink close together to the bottom of the containing vessel.

Sal catharticus, glauber salt, nitrum vitriolatum, tartar, and other neutral salts, though they counteract putrefaction in the mixed or solid parts of animals, seem to have little effect on oils with respect to their edulcoration, and cannot therefore be ranked amongst the substances proper to be used for that purpose.

Lead reduced to the state of a calx, either in the form of minium or litharge, has a strong edulcorative power on fetid oils, and is indeed applied to that end, with respect to one kind of vegetable oil, for a very bad purpose, considering its malignant qualities on the human body.

In the case of train-oil, which will scarcely ever be considered among the esculent kinds in this country, the same objection against its use would not lie; and employed either with or without heat, it is a powerful absorbent both of the putrid and empyreumatic parts that occasion the fœtor.

As however there may be some prejudice against its use, even in any way, and as it is not absolutely necessary, I have not given it a place among the ingredients of the processes I recommend.

The ochrous earth of iron, commonly called red ochre, has an absorbing power on the putrid parts of oil, but combines so strongly, that the separation is tedious even with the addition of brine; if, nevertheless, it is added when chalk and lime have been some time commixed with the oil, as in process the first, it will promote the edulcorative intention, and will subside along with them; and, as it has some advantage without increasing the expence, unless in the most inconsiderable degree, its use may be expediently admitted in that process.

Essential and ethereal oils are applicable to the prevention of putrefaction in the mixed and solid parts of vegetables, but are not so to the edulcoration of fetid oils; and if they had the desired effect, they would not, on account of their price, answer the commercial end, unless the due effect was produced by adding them to the oils in a very small quantity.

The same holds good of spirits of wine as of essential and ethereal oils, both with respect to their efficacy and the expense.

Water has an edulcorative action on fetid oils, by carrying off the most putrid parts of the gelatinous fluid or bile, in which, as was above explained, the principal fœtor resides, if the quantity added be large, and an intimate commixture be made of them by stirring them together for a considerable time: this only partially removing those heterogeneous putrescent substances, the remaining part soon acquires the same state and the oil again grows fetid, though not to the same degree as before.

Water is, however, a necessary medium for the action of salts and the separation of alkaline earths and calces of metals, when they are employed for the edulcoration of oils, as will appear from a consideration of my processes.

Air edulcorates oil by carrying off the most putrid parts, which are necessarily extremely volatile. It may be made to act on them either by simple exposure of them to it with a large extent of surface, or by forcing it through them by means of ventilators as has been practised by some dealers; but is now, I believe, neglected on account of their finding the improvement of oils by it not adequate to the trouble, as the gelatinous matter and bile, not reduced to a certain degree of putrefaction, being left behind, putrify again to nearly the same degree as before.

It appears from these several observations, that the cheapest ingredients which can be used for the edulcoration of Train-oils, are lime and chalk, which may, with the addition of a proper quantity of solution of sea-salt or brine, be made to procure a separation of them from the oils, according to process the first, so as to answer for some purposes; that the lixiviate salt is the most powerful purifier of oils, and, with the assistance of chalk and brine, will, without heat, according to process the second, effect a very considerable degree of edulcoration; and that lixiviate salt used with heat, with the addition of lime and chalk, to save a part of the quantity which would otherwise be necessary, and of brine to procure a quick separation, will perform an edulcoration sufficient for all commercial purposes, according to process the third ; but that calcined lead and the ochrous earth of iron may, perhaps, be applied in some cases with advantage, where the oil is not designed for esculent use.

PROCESS THE FIRST.

For purifying Fish-oil in a moderate degree, and at a very little expense.

TAKE an ounce of chalk in powder, and half an ounce of lime slacked by exposure to the air; put them into a gallon of stinking oil, and, having mixed them well together by stirring, add half a pint of water, and mix that also with them by the same means. When they have stood an hour or two, repeat the stirring, and continue the same treatment at convenient intervals for two or three days; after which, superadd a pint and a half of water, in which an ounce of salt is dissolved, and mix them as the other ingredients, repeating the stirring, as before, for a day or two. Let the whole then stand at rest, and the water will sink below the oil, and the chalk subside in it to the bottom of the vessel. The oil will become clear, be of a lighter colour, and have considerably less smell, but will not be purified in a manner equal to what is effected by the other processes below given; though, as this is done with the expense of only one ounce of salt, it may be practised advantageously for many purposes, especially as a preparation for the next method, the operation of which will be thereby facilitated.

PROCESS THE SECOND.

To purify, to a great degree, Fish-oil without Heat.

Take a gallon of crude stinking oil, or rather such as has been prepared as above mentioned, and add to it an ounce of powdered chalk; stir them well together several times, as in the preceding process; and after they have been mixed some hours or a whole day, add an ounce of pearl-ashes, dissolved in four ounces of water, and repeat the stirring as before. After they have been so treated for some hours, put in a pint of water, in which two ounces of salt are dissolved, and proceed as before: the oil and brine will separate on standing some days, and the oil will be greatly improved both in smell and colour. Where a greater purity is required, the quantity of pearl-ashes must be increased, and the time before the addition of the salt and water prolonged.

If the same operation is repeated several times, diminishing each time the quantity of ingredients one half, the oil may be brought to a very light colour, and rendered equally sweet in smell with the common spermaceti oil.

By this process the cod-oil may be made to burn; and, when it is so putrid as not to be fit for any use, either alone or mixed, it may be so corrected by the first part of the process, as to be equal to that commonly sold: but where this process is practised in the case of such putrid oil, use half an ounce of chalk and half an ounce of lime.

PROCESS THE THIRD.

To purify Fish-oil with the assistance of Heat, where the greatest purity is required, and particularly for the Woollen Manufacture.

Take a gallon of crude stinking oil, and mix with it a quarter of an ounce of powdered chalk, a quarter of an ounce of lime, slacked in the air, and half a pint of water; stir them together; and when they have stood some hours, add a pint of water and two ounces of pearl-ashes, and place them over a fire that will just keep them simmering, till the oil appears of a light amber colour, and has lost all smell except a hot, greasy, soap-like scent. Then superadd half a pint of water in which an ounce of salt has been dissolved; and having boiled them half an hour, pour them into a proper vessel, and let them stand till the separation of the oil, water, and lime be made, as in the preceding process. Where this operation is performed to prepare oil for the Woollen Manufacture, the salt may be omitted; but the separation of the lime from the oil will be slower, and a longer boiling will be necessary.

If the oil be required yet more pure, treat it, after it is separated from the water, &c. according to the second process, with an ounce of chalk, a quarter of an ounce of pearl-ashes, and half an ounce of salt.

Observations on Process the First.

This process may be performed on any kind of fish or seal-oil that is putrid and stinking, and will improve it in smell, and generally render the colour lighter, if previously dark and brown: it will also conduce to render these oils fitter for burning, which are, in their crude state, faulty in that point; but it will not meliorate them to the full degree they admit of even without heat, and should therefore be practised when only a moderate improvement is required.

Secondly. When the oil is taken off from the dregs and brine, the dregs which swim on the brine should be taken off it also, and put into another vessel of a deep form; and on standing, particularly if fresh water be added and stirred with them, nearly the whole remaining part of the oil will separate from the foulness; or, to save this trouble, the dregs, when taken off, may be put to any future quantity of oil that is to be edulcorated by this method, which will answer the same purpose.

Observations on Process the Third.

First.—This is most advantageously performed on Train-oil, called vicious whale-oil; and the more putrid and foul it may be, the greater will be the proportionable improvement, especially if there be no mixture of the other kinds of Fish-oils, particularly the seal, which do not admit of being edulcorated perfectly by means of heat, but require other methods: but when the vicious oil is pure from admixture of others, however stinking it may be, the bad smell will be removed by this process duly executed, and the brown colour changed to a very light amber; and these qualities will be much more permanent in this than in any crude oil, as it will not, from the degree of purity to which it is brought, be subject to putrify again under a great length of time, whether it be kept open or in close vessels.

The oil in this state will burn away without leaving the least remains of foulness in the lamp; and, being rendered more fluid than before, will go further, when used in the Woollen Manufacture, than any other kind, and will be much more easily scoured from the wool.

If nevertheless there be any branches of the Woollen Manufacture which require the use of a more thick and unctuous oil, this may be rendered so by the addition of a proper quantity of tallow or fat, of which a certain proportion will perfectly incorporate with the oil, the fluidity and transparency being still preserved, as well as all the other qualities that render it suitable to the intended purpose. This may be most beneficially done by adding a proper quantity of the refuse grease of families, commonly called *kitchen-stuff*, which being put to the oil, when moderately heated, will immediately dissolve in it, and let fall also its impurities or foulness to the bottom of the vessel, and render the purified admixture a considerable saving to the manufacturers.

Secondly. The different qualities and dispositions of different parcels of vicious oil with respect to edulcoration, render various proportions necessary of the ingredients to be used. The quantities stated in the above process are the least which will effect the end in general, and frequently greater will be required; but this may always be first tried; and if it be found, after six or eight hours simmering of the mixture, that no gradual improvement is making in the smell and colour, but that the oil continues the same in those particulars, and remains also mixed with the chalk and lime, and in a thick turbid state, a fourth or third part of the first quantity of pearl-ashes should be added, and the simmering continued till the oil be perfect. As the quantity of the water is lessened by the evaporation, it is necessary to make fresh additions from time to time, that there may be always nearly the original proportion.

Thirdly. If it be inconvenient to give the whole time of boiling at once, the fire may be suffered to go out and be re-kindled at any distance of time; and if, in such case, a small proportion of pearl-ashes dissolved in water be added, and the mixture several times stirred betwixt the times of boiling, it will facilitate the operation. The time of boiling may be also much shortened, if the chalk, lime, and pearl-ashes, be added for some days before, and the mixture frequently stirred.

PROCESS THE FOURTH,

Which may be practised alone, instead of Process the First, as it will edulcorate and purify Fish-oil to a considerable degree, so as to answer most purposes, and for Process the Third, when the whole is performed.

Take a gallon of crude stinking oil, and put to it a pint of water poured off from two ounces of lime slacked in the air; let them stand together, and stir them up several times for the first twenty-four hours; then let them stand a day, and the lime-water will sink below the oil, which must be carefully separated from them. Take this oil, if not sufficiently purified for your purpose, and treat it as directed in Process the Third, diminishing the quantity of pearl-ashes to one ounce, and omitting the lime and chalk.

ROBERT DOSSIE.*

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* The Dregs, remaining after the sundry processes above mentioned, will form an excellent Manure; as has been since noticed in Dr. Hunter's Georgical Essays.